# Fuel Gas Measurement

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AMERICAN PETROLEUM INSTITUTE

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**Measurement Coordination**

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## Introduction

This document provides a performance-based methodology for the measurement and reporting of fuel gas consumption. Specifically, considerations are provided for measurement device selection, installation, maintenance, calibration and documentation to achieve the targeted performance in terms of availability and uncertainty. If the performance of any installed measurement device is determined not to be in compliance with an acceptable level of uncertainty, the measurement device, its installation, or maintenance practices, etc. can be upgraded. Techniques are described to assess the uncertainty contribution of individual components of fuel gas measurement systems and the overall facility fuel gas measurement uncertainty. By following the guidance and calculation procedures of this document, cost effective fuel gas measurements of appropriate quality can be achieved. In most cases the rigorous requirements of industry standards intended for custody transfer quality measurements can be reduced and still achieve the desired measurement uncertainty. For this document, a fuel gas system in a facility could be comprised of multiple fuel gas meters or a single meter.

This document addresses the most common fuel gas measurement devices in use at the time of its development. This does not advocate the use of these devices or preclude the utilization of other types of devices, provided the targeted performance is achieved.

This Technical Report (TR) includes a brief description of the working principles of different types of fuel gas meters and their influence parameters, installation recommendations, a uniform method to ascertain the measurement uncertainty, a recommended method to determine the frequency of maintenance, performance verification or calibration of the meter and secondary instruments, and other relevant and necessary information.

Fuel gas can be measured by different types of flow meters. The selection of a meter typically depends on several factors such as:

- desired accuracy for the application;
- desired accuracy verification capability (i.e. calibration, inspection, replacement);
- life expectancy;
- operating conditions and their variability – flow rate, pressure, temperature, gas composition/density, etc.;
- cost of initial installation;
- operational requirements;
- regulatory requirements.

Listed below are different flow meters that are typically installed to measure the fuel gas flows in the industry. The selection of the fuel gas meter by the user may include other types of meters not included in this list:

- differential-pressure or head-type flow meters;
- displacement flow meters;
- turbine flow meters;
- thermal dispersion flow meters;
- Coriolis force flow meters;
- ultrasonic flow meters;
- vortex flow meter.

# Fuel Gas Measurement

## 1 Scope

This Technical Report (TR) provides guidance in the following areas to allow the user to achieve a targeted uncertainty of measurement:

— selection of flow meter type; differential pressure (DP), displacement, ultrasonic, Coriolis, vortex, turbine, thermal, and others;

— associated instrumentation for measuring fluid properties and flowing conditions, such as pressure and temperature transmitters, densitometers, gas chromatographs;

— obtaining and use of gas composition or other analytical data;

— design and installation requirements of the measurement system;

— inspection, verification and calibration practices of flow meters and their associated accessory instrumentation; and

— simplified uncertainty calculations with examples to illustrate the methodology.

## 2 Terms and Definitions

For the purposes of this document, the following definitions apply.

**2.1**
**accuracy**
The ability of a measurement instrument to indicate values closely approximating the true value of the quantity measured.

**2.2**
**bias**
Any influence on a result that produces an incorrect approximation of the true value of the variable being measured. Bias is the result of a predictable systematic error.

**2.3**
**calibration**
The process or procedure of adjusting an instrument so that its indication or registration is in satisfactorily close agreement with a reference standard.

**2.4**
**carbon content**
The fraction of carbon in the fluid expressed as percent by weight.

**2.5**
**compensation**
The adjustment of the measured value to reference conditions (e.g. pressure compensation).

**2.6**
**fuel gas**
Typically a mixture of light hydrocarbon and other molecules (e.g. $H_2$, $N_2$) in a gaseous state that are consumed in fired heaters. Fuel gas is often a mixture of recovered gaseous molecules from plant operations and purchased natural gas.